

Office of Nuclear Regulatory Research

Update of Seismic Source Characterization Models in the Central and Eastern United States.





The Central and Eastern United States Seismic Source Characterization for Nuclear Facilities Project

Background

Title 10 of the Code of Federal Regulations 100.23, "Geologic and seismic siting criteria," requires the following:

- determination of safe shutdown earthquake (SSE)
- use of probabilistic seismic hazard analysis (PSHA) to account for uncertainties in estimates of the SSE

A Seismic Source Characterization (SSC) model:

- constitutes a key input to a PSHA
- describes where earthquakes will occur, how big they will be, and how often they will happen

Elements of a PSHA used to produce design ground motions. Seismic sources are identified and characterized (A) and (B) and those results are used with ground motion prediction models (C) to produce seismic hazard results (D) from which uniform hazard spectra (E) are developed and used to develop design ground motions.

 requires updating. Current Central and Eastern United States (CEUS) SSC models are more than 20 years old.

The US NRC partnered with the Electric Power Research Institute (EPRI) and the US Department of Energy (DOE) to co-sponsor the CEUS SSC for Nuclear Facilities Project which will lead to a stable, durable, consistent and fully updated generic SSC model for the CEUS.

Existing Seismic Hazard Models

Two major studies were conducted in the 1980s:

- Electric Power Research Institute-Seismicity Owners Group (EPRI-SOG)
- Lawrence Livermore National Laboratory (LLNL)
 Regulatory Guide 1.208, "A Performance-

Regulatory Guide 1.208, "A Performance-Based Approach To Define the Site-Specific Earthquake Ground Motion," allows the use of EPRI-SOG and LLNL as a starting point.

 Any available new information related to a seismic source that impacts the hazard calculations must be evaluated and incorporated into the PSHA.

Updates to these hazard models present time, cost, and consistency issues.

s: Updated model will include:

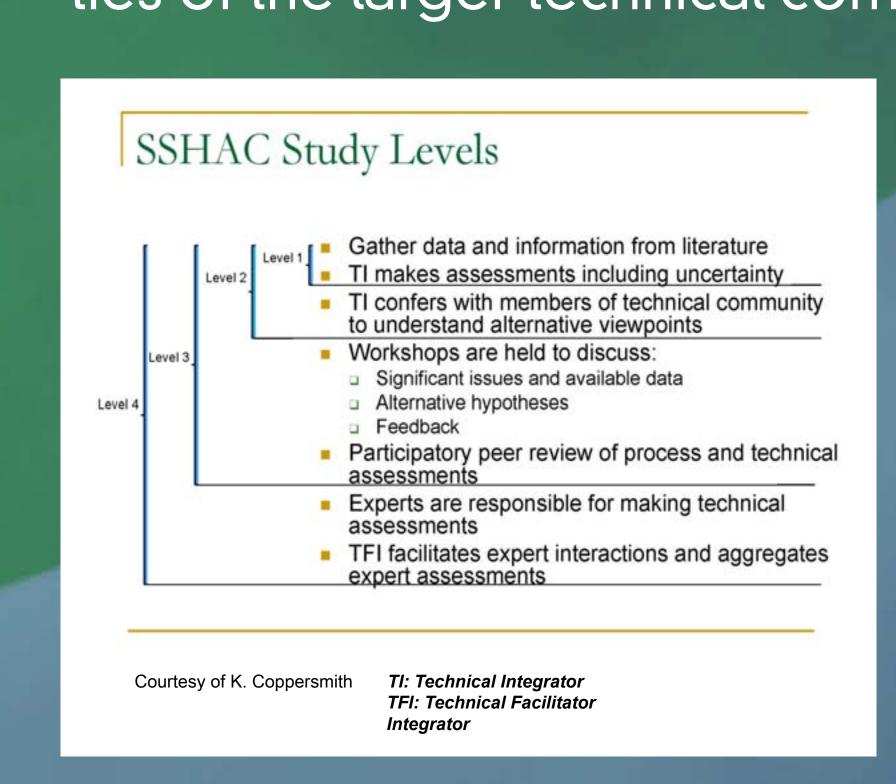
- full assessment and incorporation of uncertainties
- incorporation of the range of diverse technical interpretations from the informed scientific community
- consideration of an up-to-date database
- proper documentation
- peer review

Senior Seismic Hazard Analysis Committee (SSHAC) Guidance

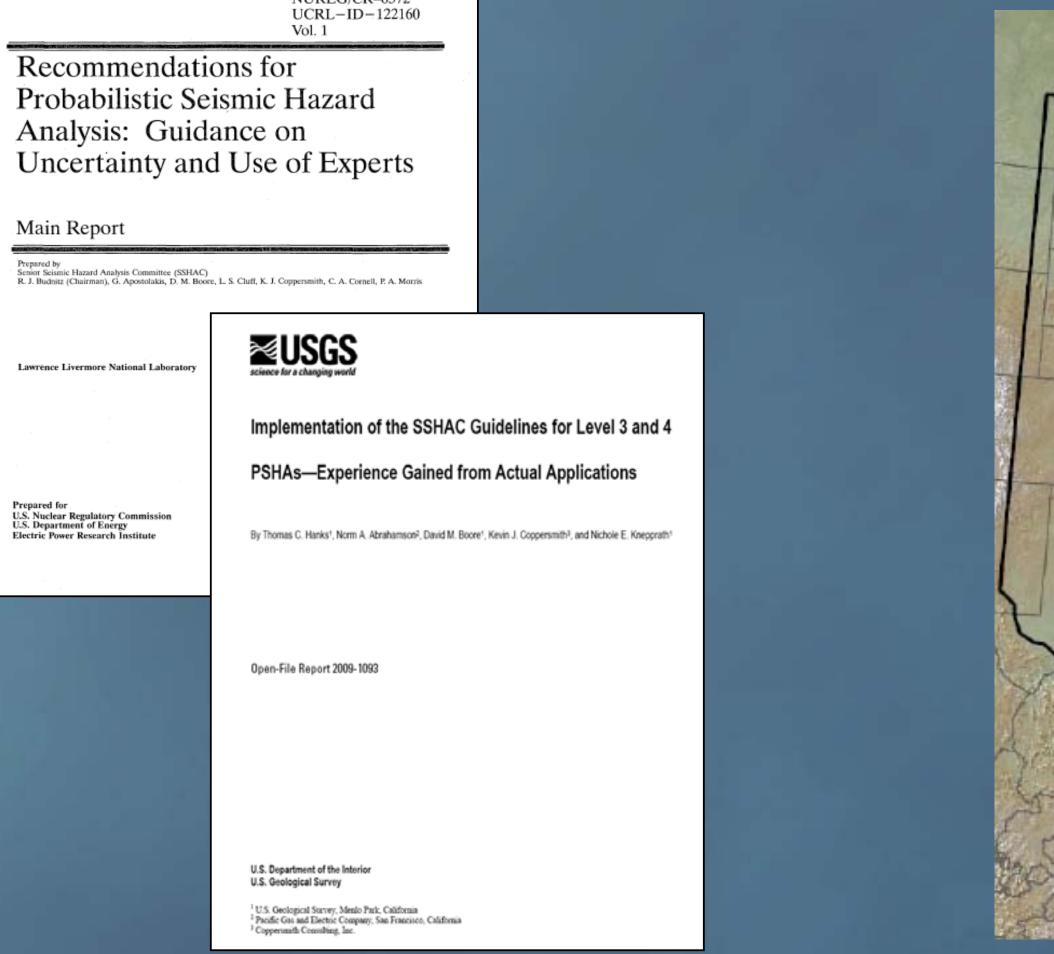
This project is being conducted using processes described in the SSHAC guidance (NUREG/CR-6372, "Recommendations for Probabilistic Seismic Hazard Analysis: Guidance on Uncertainty and Use of Experts") and incorporating the lessons learned from previous SSHAC studies as documented in United States Geological Survey Open-File Report 2009-1093, "Implementation of the SSHAC Guidelines for Level 3 and 4 PSHAs -- Experience Gained from Actual Applications". SSHAC concluded that the goal of all PSHA should be:

"To represent the center, the body, and the range of the technical interpretations that the larger informed technical community would have if they were to conduct the study."

The SSHAC guidance defines four Study Levels (see SSHAC Study Levels diagram), to capture the knowledge and uncertainties of the larger technical community.



The CEUS SSC for Nuclear Facilities Project is being conducted using a Study Level 3 process for the key SSC issues.



Project Scope and Status

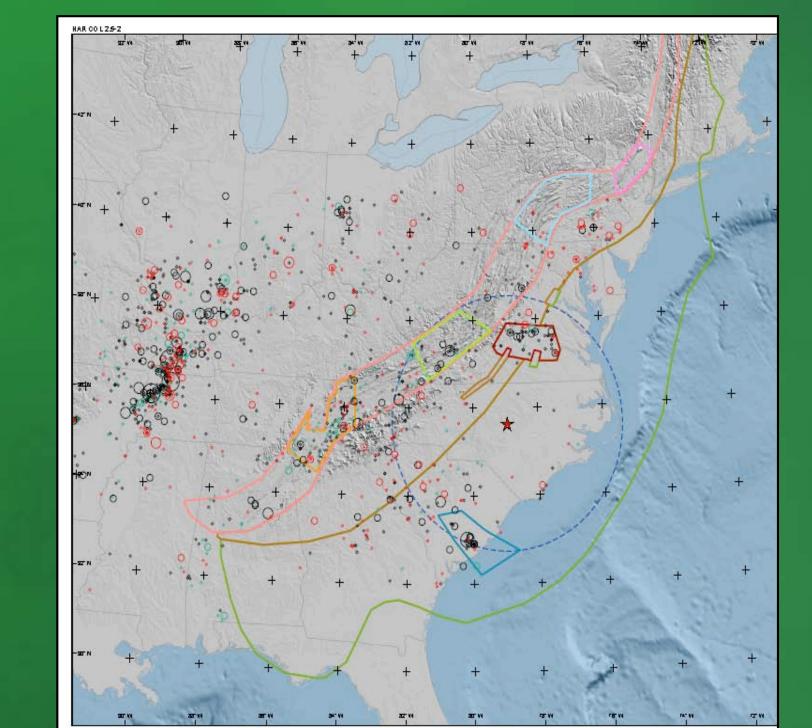
The CEUS SSC for Nuclear Facilities Project team consists of a technical integration (TI) team, TI staff, a participatory peer review panel (PPRP), sponsors, and agency experts.

The work consists of several tasks and three workshops over a 3-year period, as follows:

- Develop Project Plan defining a SSHAC Study Level 3 approach, team personnel & functions, work plan, and schedule. (Completed)
- Develop a CEUS geological, geophysical, and seismological database in GIS format with an emphasis on data important for the SSC efforts. (Completed)
- Update the CEUS earthquake catalog to merge and reconcile several regional catalogs and to develop uniform moment magnitudes. (Completed)
- Workshop 1: Identify hazard-significant SSC issues and identify and discuss important databases with resource experts. (Completed)
- Workshop 2: Present, discuss, and debate alternative interpretations of significant seismic source issues with proponents of alternative models. (Completed)
- Construct a preliminary SSC model, and perform hazard calculations and sensitivity analyses. (Completed)
- Seismic hazard calculations to identify sensitivities are being conducted at seven sites selected to represent differing hazard environments.
- Workshop 3: Present preliminary SSC model, discuss hazard feedback, sensitivity analyses and uncertainties, and obtain feedback from resource experts. (Completed)
- Finalize SSC model including quantifying all uncertainties. (On schedule)
- Develop draft CEUS SSC project report for review. (On schedule)
- Support reviews by PPRP, sponsors and oversight groups. (On schedule)
- Complete project in the 2nd quarter of fiscal year 2011.



Study area for CEUS SSC for Nuclear Facilities Project showing seven sites used for sensitivity analyses



1989 EPRI-SOG Source Regions



right figure shows the much broader source zones utilized in the 2008 USGS seismic hazard model.

conceptual models for

ntification of potential

emic sources in the CEUS.

Knowledge for Today and Tomorrow